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Blended observational datasets

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Observational datasets are changing

Past:

- Manual *in situ* observations, paper records, multiple formats
- The challenge to digitise data and apply quality control

Present:

- Automated *in situ* observation platforms (e.g. AWS), automated digital data flow
- The challenge to automate quality control

Future:

- Data from multiple sources: *in situ*, remote sensing, atmospheric reanalysis
- The challenge to blend datasets with different temporal and spatial characteristics

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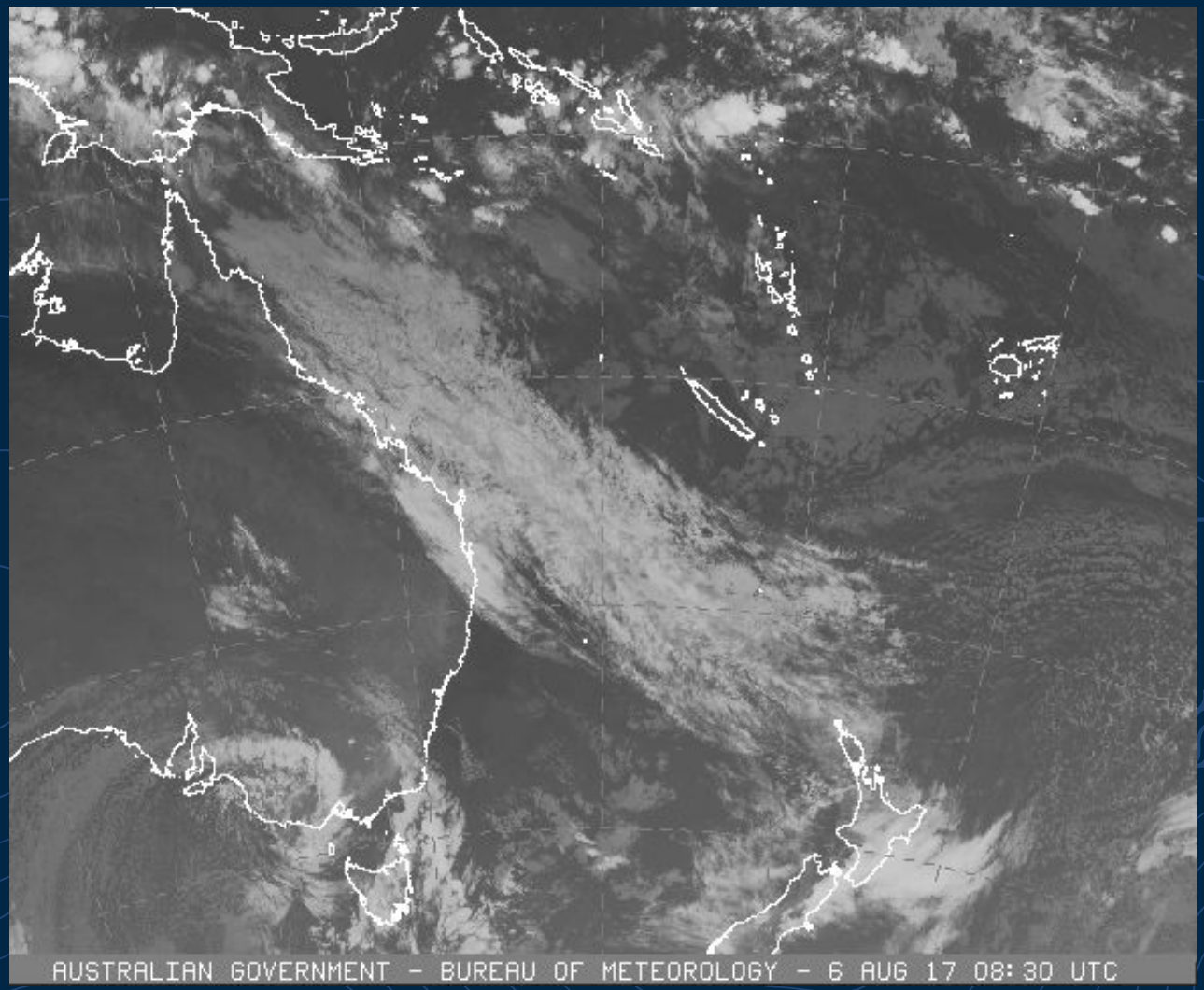
Remotely sensed data

Himawari 8 – infrared channel



- Geostationary satellite
- 16 channels in visible to infrared
- 0.5 to 2km resolution
- Full disk scan every 10 minutes

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Example – Evapotranspiration

Combined evaporation due to soil and crop

$$ET_o = \frac{0.408\Delta(R_n - G) + \gamma \frac{900}{T_{mean} + 273} u_2 (e_s - e_a)}{\Delta + \gamma(1 + 0.34u_2)}$$

Class A Evaporation Pan

By Bidgee - Own work, CC BY 3.0,
https://commons.wikimedia.org/w/index.php?curid=391066

- Reference equation allows a good approximation from weather data
  - Fixed albedo and crop type
- Pan evaporation integrates the effects of temperature, humidity, wind and radiation
  - Less reliable than Ref. Eq.
  - *In situ* measurement
- Satellite temperature, radiation and albedo also can be used as an approximation
  - Full spatial coverage
  - How to relate this to *in situ* measurements?

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Atmospheric reanalysis

- **Historical, 3-dimensional description of the atmosphere**, produced by optimally combining many observations and best model physics in retrospective (i.e. an "analysis“)
- Use of **unchanging methods (**analysis scheme and physical models) to perform this "analysis" with all available observations

Courtesy: Chun-Hsu Su (adapted)

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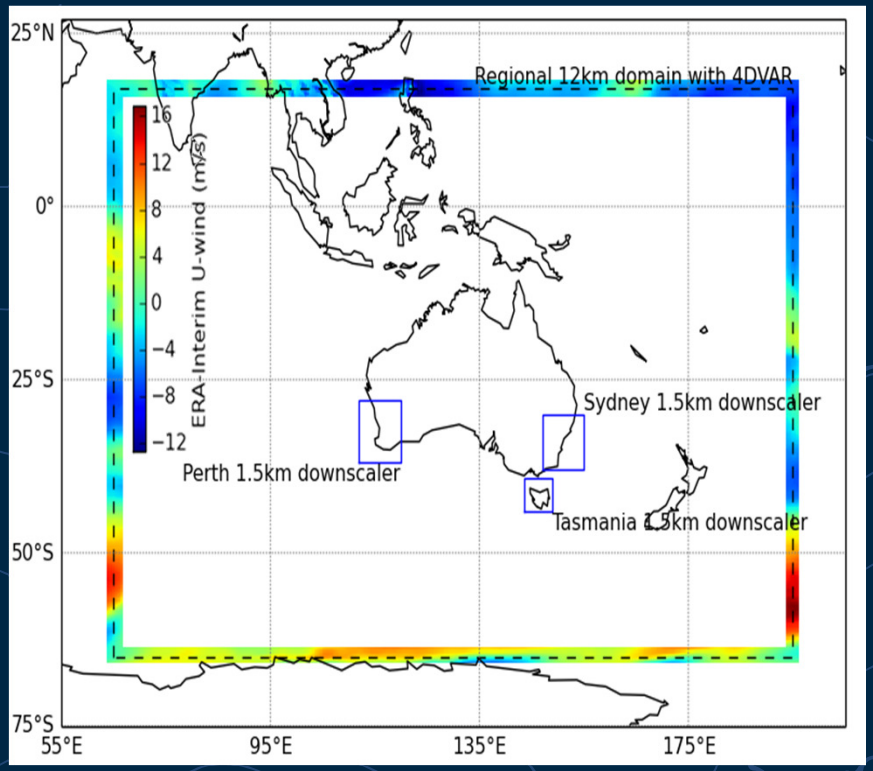
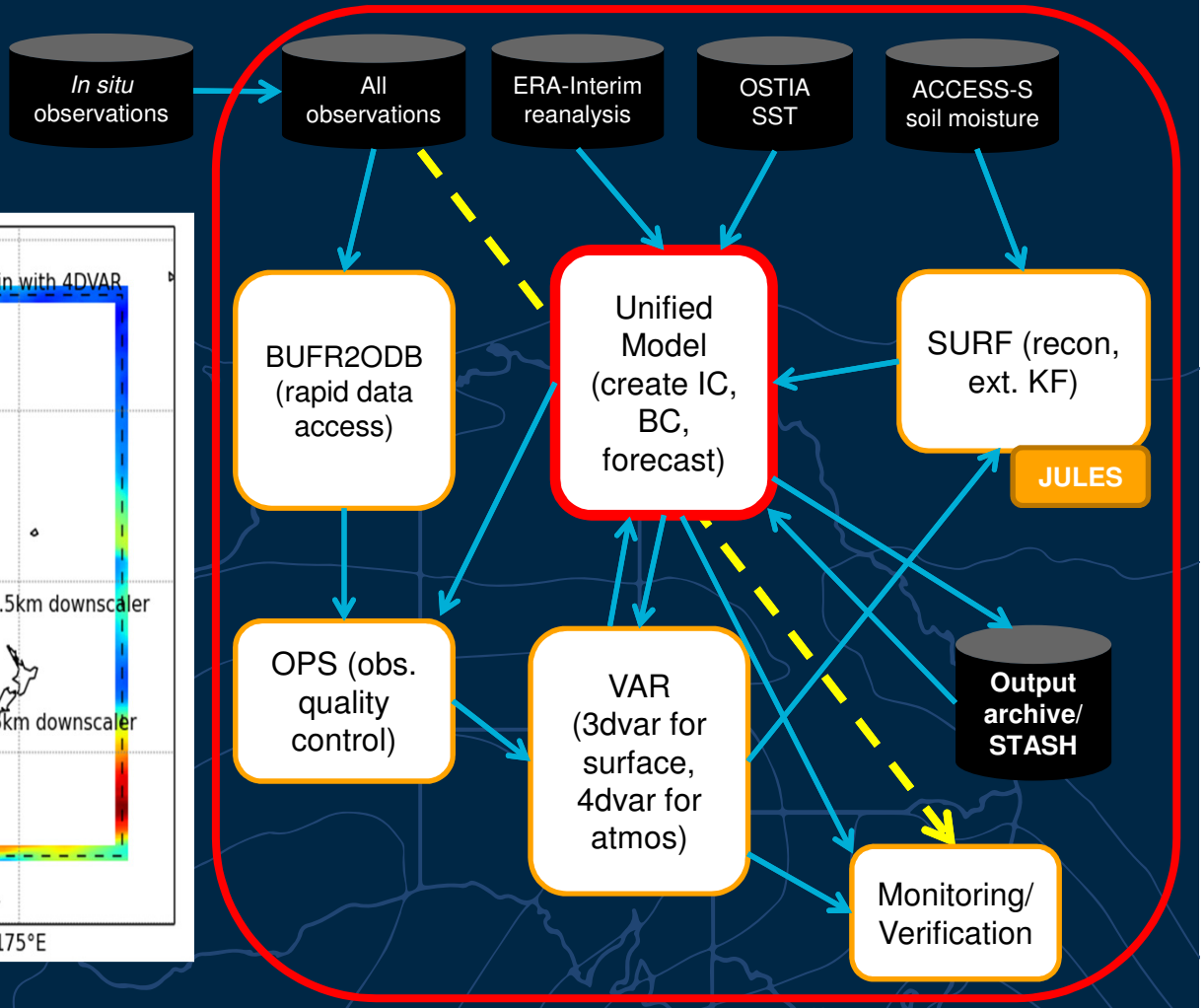
In situ observations are a small part of a reanalysis





Setup	Resolution	Techniques	Model	Output
Regional	12km	4DVar, 3DVar (screen), VarBC, SURF-EKF	UM10.2	Hourly, and 10min fields
Sub-domains	1.5km	Hindcast setup	UM10.6	Ditto

Courtesy: Chun-Hsu Su (adapted)

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Observational equipment is changing

- Example: *In situ* temperature measurements
  - Temperature instrument
  - Instrument shelter
  - Automatic Weather Station (AWS)
- For continuity of long-term climate records, statistically test equipment changes for inhomogeneities
  - Recent equipment changes have had no impact on the historical Australian temperature record

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Challenges

- Blending of data on different spatial and temporal scales to enable continuity of measurement of important climate variables
- Use of contemporary reanalysis data to characterise the uncertainty in spatial analyses of historical observations
- Complementing homogenisation methods with experimental design to maintain the continuity of climate data sets in future *in situ* networks